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EXAMINER

BARTON, JEFFREY THOMAS

ART UNIT	PAPER NUMBER
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1795

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PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary

Application No.

10/696,545

Applicant(s)

DENG, XUNMING

Examiner

Jeffrey T. Barton

Art Unit

1795

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 06 September 2007.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-30 and 70-74 is/are pending in the application.
- 4a) Of the above claim(s) 17-30 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-16 and 70-74 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date 20040428.
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____.
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: _____.

DETAILED ACTION

Election/Restrictions

1. Applicant's election of Group I, species A (Claims 1-16 and 70-74) in the reply filed on 06 September 2007 is acknowledged. Because applicant did not distinctly and specifically point out the supposed errors in the restriction requirement, the election has been treated as an election without traverse (MPEP § 818.03(a)).
2. Claims 17-30 are withdrawn from further consideration pursuant to 37 CFR 1.142(b) as being drawn to a nonelected invention, there being no allowable generic or linking claim. Election was made **without** traverse in the reply filed on 06 September 2007.

Claim Objections

3. Claims 1, 3-6, 16, and 73 are objected to because of the following informalities: Claim 3 recites "photovoltaic cell including" at lines 1-2 of the claim, although it appears "photovoltaic cell includes" was intended. In line 1 of each of claims 4, 5, and 6, the hyphen should be removed from each recitation of "window-layer". In claim 1 at line 5 and claim 16 at line 1, the hyphen should be removed from "absorber-layer". In claim 73 at lines 2-3, "the a TCO layer" is recited, although it appears "and a TCO layer" was intended. Appropriate correction is required.

Claim Rejections - 35 USC § 112

4. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

5. Claims 7-9, 73, and 74 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

In claim 7 at lines 1-2, there is no positive antecedent basis for "the desirable deposition conditions".

In claim 8 at line 1, the recitation "the sub-window-layer" is indefinite because it is unclear whether the limitation applies to the "first sub-window-layer" or the "second sub-window-layer", or both.

In claim 9 at line 1, there is no positive antecedent basis for "the deposition parameter".

In claim 73 at line 2, there is no positive antecedent basis for "the n-layer", since the n-type layer of claim 4 is optional. It is recommended that the claim be amended to include "wherein the doped window layer comprises the n-type layer" after the preamble of the claim.

In claim 74 at line 3, there is no positive antecedent basis for "the p-layer", since the p-type layer of claim 4 is optional. It is recommended that the claim be amended to include "wherein the doped window layer comprises the p-type layer" after the preamble of the claim. There is also no antecedent basis for "the TCO layer" in line 3 of the claim.

Claim Rejections - 35 USC § 102

6. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

7. Claims 1-12, 14-16, 70, and 72-74 are rejected under 35 U.S.C. 102(b) as being anticipated by Kishimoto et al. (US 6,242,686) Supporting information is provided by Kymakis et al.

Regarding claim 1, Kishimoto et al disclose a photovoltaic cell (Figure 2) comprising: an absorber layer (4); a doped window layer having two sublayers (7 and 8); wherein the first sub-window-layer (8) is adjacent the absorber layer (4) and forms a desirable junction with the absorber layer and wherein the second sub-window-layer (7) is adjacent the first sub-window layer and has high optical transmission. (Column 8, line 60 - Column 9, line 31; 2 nm thick layer 7 will have high optical transmission)

Regarding claims 2, 3, 16, and 70, thin film silicon alloys as claimed are disclosed by Kishimoto et al. Kishimoto et al specifically teach a-SiGe:H, which meets all structural limitations of claim 70, given the broad interpretation permitted by the terms "minimal" light-induced degradation and "high" conversion efficiency. The cells taught by Kishimoto et al are considered to meet these limitations. (Column 4, line 65 - Column 5, line 5; Column 6, lines 7-9)

Regarding claims 4, 8 and 15, Kishimoto et al disclose layers 7 and 8 being p-type silicon-containing layers. (Column 8, lines 61-65)

Regarding claims 5-7 and 9, undue weight cannot be given to limitations to the method by which a product is made. "[E]ven though product-by-process claims are limited by and defined by the process, determination of patentability is based on the product itself. The patentability of a product does not depend on its method of production. If the product in the product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process." *In re Thorpe*, 777 F.2d 695, 698, 227 USPQ 964, 966 (Fed. Cir. 1985) However, Kishimoto et al do use PECVD to deposit layers 7 and 8 (Column 9, lines 6-22; Column 6, line 63 - Column 7, line 2) In addition, gas mixtures, pressure, power, temperature, and the other deposition parameters were selected by Kishimoto et al to provide the desired films. (Column 9, lines 6-22)

Regarding claim 10, Kishimoto teach a device as shown in Figures 8 and 9, which also meets the limitations of claim 1, with layer 10 corresponding to the instant first sub-window-layer. Kishimoto et al report $V_{oc}=0.92V$, $I_{sc}=16.5 \text{ mA/cm}^2$, and $FF=0.73$ for this cell. (Column 11, line 23 - Column 12, line 3) This cell has over 10% efficiency according to the formula taught by Kymakis et al, with the incident power of AM 1.5 radiation considered to be 100 mW/cm^2 . (Kymakis et al, page 1765, 1st column, 1st full paragraph)

Regarding claim 11, Kishimoto et al disclose a substrate (1) made of glass. (Column 8, lines 61-65)

Regarding claim 12, Kishimoto et al disclose a transparent conductive oxide (2) adjacent the second sub-window-layer (7). (Column 8, line 61 - Column 9, line 5)

Regarding claim 14, Kishimoto et al disclose a device as shown in Figures 8 and 9, and teach that layer 10 is deposited as two distinct layers deposited in sequence with a plasma treatment provided between deposition steps. (Column 11, lines 42-51) The first of these distinct layers, which is adjacent to second sub-window-layer 7, reads on the instant first sub-window-layer. The second of these distinct layers, which is adjacent to i-layer 4, reads on the instant buffer semiconductor layer.

Regarding claim 72, undue weight cannot be given to limitations to the method by which a product is made. "[E]ven though product-by-process claims are limited by and defined by the process, determination of patentability is based on the product itself. The patentability of a product does not depend on its method of production. If the product in the product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process." *In re Thorpe*, 777 F.2d 695, 698, 227 USPQ 964, 966 (Fed. Cir. 1985) It is the examiner's position that the second p-type layer, which is doped by diffusion from underlying highly-doped p-type layer 7 and from residual dopant present in the chamber has the same gradient structure as would result from continually changing conditions as claimed.

Regarding claim 73, p-type layer 7 has dopant concentration of 10^{18} cm^{-2} or higher, and lies between TCO layer 2 and n-type layer 5, which has dopant concentration as low as 10^{18} cm^{-2} . (Figure 2; Column 5, lines 15-19; Column 6, lines 10-12) Clearly the scope of Kishimoto et al includes a p-type layer 7, which is the only

layer disclosed as "highly doped", having a higher dopant concentration than n-type layer 5. This meets the limitations of claim 73 as currently recited.

Regarding claim 74, Kishimoto et al teach that p-type layer 7 has higher dopant concentration than p-type layer 8, and that layer 8 is significantly thicker than layer 7. (Column 8, line 61 - Column 9, line 22) Layer 7 therefore reads on the instant "heavily doped interface layer" as claimed.

8. Claims 1-9, 11, 12, 14, and 15 are rejected under 35 U.S.C. 102(b) as being anticipated by Sano et al. (US 2001/0037824)

Regarding claim 1, Sano et al disclose a photovoltaic cell (Figure 2) comprising: an absorber layer (14); a doped window layer having at least two sublayers (13, 17); wherein the first sub-window-layer (13) is adjacent the absorber layer (14) and forms a desirable junction with the absorber layer and wherein the second sub-window-layer (17) is adjacent the first sub-window layer and has high optical transmission. (Paragraphs 0034-0042; thicknesses of 1-8 nm are preferred for layer 17 as disclosed in paragraph 0042, which will provide high optical transmission)

Regarding claims 2 and 3, Example 1 of Sano et al uses a-Si:H.

Regarding claims 4, 8 and 15, Sano et al disclose layer 13 being a p-type silicon-containing layer (Paragraph 0035, Example 1) and layer 17 being a silicon-containing material. (Example 1; paragraph 0041)

Regarding claims 5-7 and 9, undue weight cannot be given to limitations to the method by which a product is made. "[E]ven though product-by-process claims are

limited by and defined by the process, determination of patentability is based on the product itself. The patentability of a product does not depend on its method of production. If the product in the product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process." *In re Thorpe*, 777 F.2d 695, 698, 227 USPQ 964, 966 (Fed. Cir. 1985) However, Sano et al do use PECVD to deposit layers 13 and 17 (Example 1) In addition, gas mixtures, pressure, power, temperature, and the other deposition parameters were selected by Sano et al to provide the desired films.

(Example 1)

Regarding claim 11, Sano et al disclose a substrate (11) made of plastic.

(Paragraph 0057)

Regarding claim 12, Sano et al disclose a transparent conductive oxide (12-1 and 12-2) adjacent the second sub-window-layer (17). (Paragraph 0068)

Regarding claim 14, Sano et al disclose a device as shown in Figure 3, in which additional layer 18 is provided between p-type layer 13 and the absorber layer 14.

Layer 18 is a semiconductor, and reads on the instant buffer semiconductor layer.

(Example 7; Paragraphs 0043-0048 and 0084)

9. Claims 1-9, 11, 12, 15, 16, 70, and 72-74 are rejected under 35 U.S.C. 102(b) as being anticipated by Yamagishi et al. (US 5,032,884)

Regarding claim 1, Yamagishi et al disclose a photovoltaic cell (Figure 7, Example 13) comprising: an absorber layer (25); a doped window layer having two

sublayers (23 and 24); wherein the first sub-window-layer (24) is adjacent the absorber layer (25) and forms a desirable junction with the absorber layer and wherein the second sub-window-layer (23) is adjacent the first sub-window layer and has high optical transmission. (Column 11, line 30 - Column 12, line 35; layer 23 is disclosed as 10 nm thick at Column 11, lines 57-59, which will provide high optical transmission)

Regarding claims 2, 3, 16, and 70, thin film silicon alloys as claimed are disclosed by Yamagishi et al. (Column 7, line 55 - Column 8, line 4) Specific to claim 70, Yamagishi et al specifically teach a-SiGe:H, which meets all structural limitations of claim 70, given the broad interpretation permitted by the terms "minimal" light-induced degradation and "high" conversion efficiency. The cells taught by Yamagishi et al are considered to meet these limitations.

Regarding claims 4, 8 and 15, Yamagishi et al disclose layers 23 and 24 being p-type silicon-containing layers. (Column 11, lines 32-35)

Regarding claims 5-7 and 9, undue weight cannot be given to limitations to the method by which a product is made. "[E]ven though product-by-process claims are limited by and defined by the process, determination of patentability is based on the product itself. The patentability of a product does not depend on its method of production. If the product in the product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process." *In re Thorpe*, 777 F.2d 695, 698, 227 USPQ 964, 966 (Fed. Cir. 1985) However, Yamagishi et al do use PECVD to deposit layers 23 and 24 (Column 11, lines 50-66) In addition, gas mixtures, pressure, power, temperature,

and the other deposition parameters were selected by Yamagishi et al to provide the desired films. (Column 11, lines 50-66)

Regarding claim 11, Yamagishi et al disclose a substrate (21) made of glass. (Column 11, lines 45-47)

Regarding claim 12, Yamagishi et al disclose a transparent conductive oxide (22) adjacent the second sub-window-layer (23). (Figure 7; Column 11, lines 45-59)

Regarding claim 72, undue weight cannot be given to limitations to the method by which a product is made. "[E]ven though product-by-process claims are limited by and defined by the process, determination of patentability is based on the product itself. The patentability of a product does not depend on its method of production. If the product in the product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process." *In re Thorpe*, 777 F.2d 695, 698, 227 USPQ 964, 966 (Fed. Cir. 1985) It is the examiner's position that the graded composition of the p-type layer (24) adjacent the i-type layer (25) that is taught by the abstract and in Figure 5 is the same as would have resulted from the claimed process requiring continually changing conditions.

Regarding claim 73, p-type layer 23 has dopant concentration of 4%, and lies between TCO layer 22 and n-type layer 6, which has dopant concentration of 0.5%. (Column 11, line 50 - Column 12, line 11)

Regarding claim 74, Yamagishi et al teach that p-type layer 23 has higher dopant concentration than p-type layer 24 and lies between layer 24 and TCO layer 22.

(Column 11, lines 50-66) Layer 23 therefore reads on the instant "heavily doped interface layer" as claimed.

Claim Rejections - 35 USC § 103

10. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

11. The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

12. Claim 13 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kishimoto et al in view of Nakanishi. (US 6,222,115)

Kishimoto et al disclose a solar cell as described above in addressing claims 1-12, 14-16, 70, and 72-74.

Kishimoto et al do not explicitly disclose providing an encapsulation layer on their solar cells as claimed. Kishimoto et al are silent concerning encapsulation.

Nakanishi teaches encapsulating thin film amorphous silicon solar cells that have been deposited on a transparent substrate with EVA and a backsheet that provides a substantially airtight and watertight protective barrier as claimed. (Abstract; Column 2, lines 12-42; Table 1 and discussion)

It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the cell of Kishimoto et al by encapsulating it in the EVA and backsheet, as taught by Nakanishi, because Nakanishi teaches that this provides excellent environmental resistance to the solar module (Column 2, lines 13-16) and a skilled artisan would have recognized that cells such as those taught by Kishimoto et al require such encapsulation in order to avoid degradation upon exposure to the atmosphere.

13. Claim 13 is rejected under 35 U.S.C. 103(a) as being unpatentable over Sano et al (US 2001/0037824) in view of Nakanishi.

Sano et al disclose a solar cell as described above in addressing claims 1-9, 11, 12, 14, and 15.

Sano et al do not explicitly disclose providing an encapsulation layer on their solar cells as claimed. Sano et al are silent concerning encapsulation.

Nakanishi teaches encapsulating thin film amorphous silicon solar cells that have been deposited on a transparent substrate with EVA and a backsheet that provides a substantially airtight and watertight protective barrier as claimed. (Abstract; Column 2, lines 12-42; Table 1 and discussion)

It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the cell of Sano et al by encapsulating it in the EVA and backsheet, as taught by Nakanishi, because Nakanishi teaches that this provides excellent environmental resistance to the solar module (Column 2, lines 13-16) and a skilled artisan would have recognized that cells such as those taught by Sano et al require such encapsulation in order to avoid degradation upon exposure to the atmosphere.

14. Claim 13 is rejected under 35 U.S.C. 103(a) as being unpatentable over Yamagishi et al in view of Nakanishi.

Yamagishi et al disclose a solar cell as described above in addressing claims 1-9, 11, 12, 15, 16, 70, and 72-74.

Yamagishi et al do not explicitly disclose providing an encapsulation layer on their solar cells as claimed. Yamagishi et al are silent concerning encapsulation.

Nakanishi teaches encapsulating thin film amorphous silicon solar cells that have been deposited on a transparent substrate with EVA and a backsheet that provides a substantially airtight and watertight protective barrier as claimed. (Abstract; Column 2, lines 12-42; Table 1 and discussion)

It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the cell of Yamagishi et al by encapsulating it in the EVA and backsheet, as taught by Nakanishi, because Nakanishi teaches that this provides excellent environmental resistance to the solar module (Column 2, lines 13-16) and a

skilled artisan would have recognized that cells such as those taught by Yamagishi et al require such encapsulation in order to avoid degradation upon exposure to the atmosphere.

15. Claim 71 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kishimoto et al in view of Sano et al. (JP 08-051227)

Kishimoto et al disclose a solar cell as described above in addressing claims 1-12, 14-16, 70, and 72-74.

Kishimoto et al do not explicitly disclose the particular composition of a-SiGe:H contemplated for use in their solar cell.

Sano et al teach an i-type layer in a pin-type cell that comprises a-SiGe:H with a Ge:Si ratio of 0.29 (Paragraph 0016), which corresponds to $x=0.22$ in the instant formula.

It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the cell of Kishimoto et al by specifically using the a-SiGe:H layer having $x=0.22$ as taught by Sano et al, because Sano et al teach that this layer has reduced photodegradation (Paragraph 0012) and provides increased conversion efficiency. (Paragraphs 0007-0009) In addition, since Kishimoto et al are silent concerning the specific composition of the a-SiGe:H layer to be used in their cells, a skilled artisan would have turned to the related prior art, such as Sano et al, for teachings of suitable compositions.

16. Claim 71 is rejected under 35 U.S.C. 103(a) as being unpatentable over Yamagishi et al in view of Sano et al. (JP 08-051227)

Yamagishi et al disclose a solar cell as described above in addressing claims 1-9, 11, 12, 15, 16, 70, and 72-74.

Yamagishi et al do not explicitly disclose the particular composition of a-SiGe:H contemplated for use in their solar cell.

Sano et al teach an i-type layer in a pin-type cell that comprises a-SiGe:H with a Ge:Si ratio of 0.29 (Paragraph 0016), which corresponds to $x=0.22$ in the instant formula.

It would have been obvious to one having ordinary skill in the art at the time the invention was made to modify the cell of Yamagishi et al by specifically using the a-SiGe:H layer having $x=0.22$ as taught by Sano et al, because Sano et al teach that this layer has reduced photodegradation (Paragraph 0012) and provides increased conversion efficiency. (Paragraphs 0007-0009) In addition, since Yamagishi et al are silent concerning the specific composition of the a-SiGe:H layer to be used in their cells, a skilled artisan would have turned to the related prior art, such as Sano et al, for teachings of suitable compositions.

Conclusion

17. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Dr. Jeffrey T. Barton whose telephone number is (571) 272-1307. The examiner can normally be reached on M-F 9:00AM - 5:30PM.


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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nam Nguyen can be reached on (571) 272-1342. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

JTB
6 November 2007


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